Dense Non-Aqueous Phase Liquid (DNAPL) Cleanup Starts with Detection

Developing new technologies for finding and quantifying DNAPLs

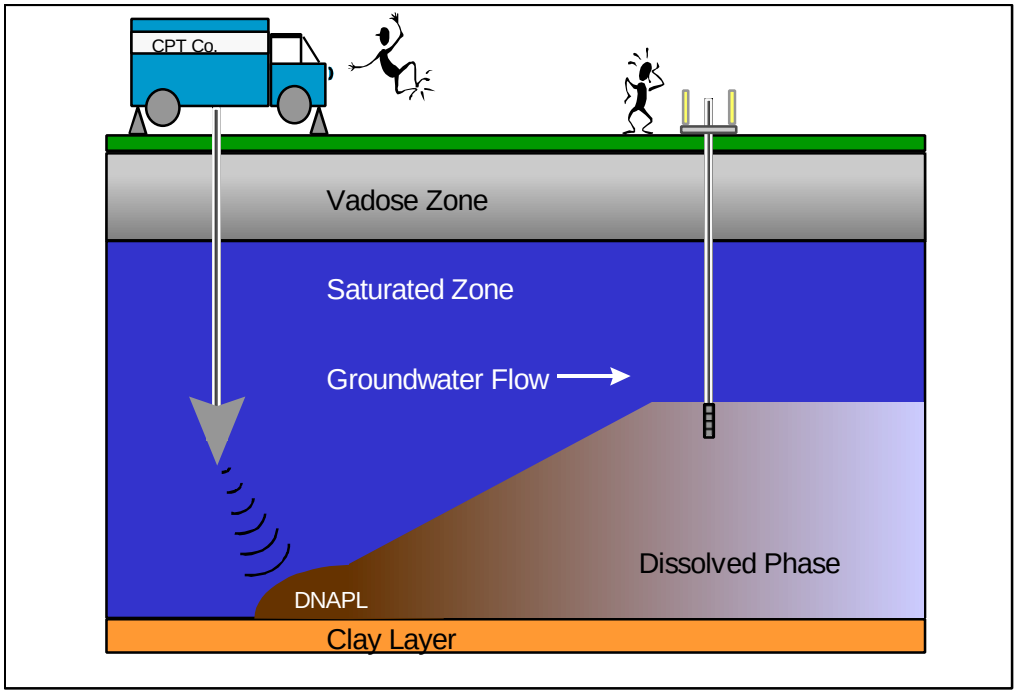
The Problem

Chlorinated solvents such as perchloroethylene (PCE) and trichloroethylene (TCE) have long been used as cleaning and degreasing agents. For many years, used solvents were placed in evaporating ponds or landfills for disposal. Chlorinated solvents are denser than water and sink through groundwater, settling in fracture zones or accumulating in depressions in the aquitard. These accumulations act as a source of groundwater contamination for many years. Even at the concentrations imposed by their low solubility, chlorinated solvents pose a hazard to human and environmental health.

Cleanup Requires Localization

DNAPL contamination is one of the biggest challenges to environmental cleanup managers. Removing dissolved solvent from groundwater does not solve the problem, as residual chemical will continue to partition into the groundwater from DNAPL accumulations. Methods do exist for treatment of these source areas, including in some cases, recovery of free-phase "pools." However, because DNAPL accumulations can be small in volume and dispersed under complex hydro-geologic conditions, they are extremely difficult to locate.

Site remediation requires new and innovative ways to locate and quantify DNAPLs prior to attempts at recovery or in situ remediation. The Air Force Research Laboratory, Materials and Manufacturing Directorate, Airbase and Environmental Technology Division (AFRL/MLQ), Tyndall Air Force Base (AFB), Florida, is collaborating with the Colorado School of Mines, Mission Research Corporation, Blackhawk Geometrics, Inc., and TechniScan, Inc. Together, the group is developing new and innovative technologies to target DNAPLs for location and cleanup.



Electromagnetic Imaging

TechniScan, Inc. is developing an electromagnetic (EM) downhole tool for DNAPL imaging. Transmitter and receiver coils are being designed and built at ElectroMagnetic Instruments Inc. and will be deployed in monitoring wells. TechniScan is developing the theory and software for 3-dimensional image production from EM data to give site managers a clearer picture of site topography, DNAPL position and volume.

Horizontal Drilling

Survey data suggest that over 80 percent of DNAPLs are 70 feet or less below the surface, placing them within reach by horizontal drill rigs. Scientists at Mission Research Corp. are designing and testing a novel tool for detection of DNAPL via horizontal bore holes. The new site characterization approach requires the integration of three technologies: directional drilling, subsurface location systems, and DNAPL sensors.

Complex Resistivity

Complex Resistivity (or Induced Polarization) is a non-invasive geophysical technique that works by detecting altered electrical properties in the clay caused by reaction of the clay with free-phase contaminants. The technology has been demonstrated at Hill AFB, Utah, and is continuing development under the Strategic Environmental Research and Development Program (SERDP). Complex resistivity can locate DNAPL solvents to aid in the evaluation of the integrity of containment systems.

Let Us Help

If you are an environmental manager with a DNAPL problem, you know that accurate site characterization is vital to your remediation planning and implementation. Let us help you identify and develop the technologies to make your cleanup as complete and economical as possible. Whether EM Imaging, Horizontal Drilling, Complex Resistivity, or some other DNAPL detection and modeling technology fits your needs, the AFRL/MLQ team at Tyndall AFB wants to help you meet your cleanup goals.

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